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Galium trifidum and its North American Allies.

By Karl M. Wiegand.

For many years this group of plants has seemed to the writer one of the most perplexing with which the American botanist has to deal. Two individuals would appear so distinct as to be at once taken for distinct species, but all text-books referred both to the one name *G. trifidum*, "an exceedingly variable species." Distrust was aroused more and more as to the correctness of this treatment of *Galium* since experience shows that species in other genera very rarely exhibit such a wide range of indefinite variation. The complexity of many aggregate species is found to be due to the confusion of distinct but closely related sub-groups, and not to one single unbroken and highly variable species. To distinguish and designate these sub-groups when they exist is unquestionably a benefit to our conception of the group as a whole, and it was on this account largely that the study was undertaken which led to the present paper.

It was soon apparent that this was the principal cause of the confusion in the case of *Galium*. *G. trifidum* L. which was designated as the "highly variable" species, although its components still exhibit a remarkable amount of variability, readily allows of segregation into a number of well defined species and as many good varieties which are as distinct as most of the other North Americal representatives of this genus. The following discussion is an attempt to bring the "*trifidum*" group into a more orderly condition.

There has always been considerable difference of opinion as to the taxonomic value of different characters in the genus *Galium*. We shall concern ourselves merely with those used to separate the species of the *trifidum* group. The conception of a species here as elsewhere, of course necessarily differs with the individual. It will be readily seen in the synopsis given below that the greatest importance is placed upon a so-called "internal character," namely the form that the seed presents in cross-section. Practically speaking this means the cross-section of the endosperm and does not include the carpellary coat. This character so far as known to the writer is here used for the first time, and a brief explanation may be necessary. The endosperm is closely surrounded by the seed-coat and usually does not fill the entire carpel. In the group with lunate cross-section the endosperm is more or less grooved upon the inner face, thus producing the crescent-shaped appearance. In the other group this groove is greatly exaggerated. Not only is it very deep, but the sides are extended until they meet at the inner angle of the carpel, and thus the endosperm becomes a hollow sphere filled at first with the cellular seed-coat, but at maturity entirely empty except for the air which it contains, and which probably aids in floating the seed upon the water. A complete discussion of the fruit characters in the genus *Galium* will soon appear in a separate paper, and therefore nothing more need be said here upon this subject. Curiously enough the type of inflorescence seems to supplement the fruit characters. In the writer's opinion the number of corolla lobes offers a specific character. The plants are not " either " 3- or 4-merous, but the small three-parted obtuse lobed corolla represents one group of species as is shown by the supplementary characters of a smooth stem and a peculiar general appearance; while the four-parted large and acute lobed corolla just as accurately defines another group of species, and the character is here again supplemented by other characters. Valuable characters have been drawn from the arrangement of the flowers and the nature of the pedicels, while the leaves have not as a whole yielded good results. Very little dependence could be placed upon the number of leaves in a whorl.

Linnaeus in 1753 described a species of *Galium* as *G. trifidum*, habitat Canada. It is necessary first of all to determine just what plant this name represents. Many of the earlier botanists were in doubt as to this point. Most of them, however, decided to include under it all the obtuse leaved forms treated in this present paper. Hooker, however, having in hand perhaps mostly material from the States, and not having seen the true American type, considered the European form distinct, and to the American plant gave Michaux's name *G. Claytoni.* After this time the two forms were again united and have remained so until the present time. It becomes evident, however, that the small bog form, the

G. trifidum var. *pusillum* Gray, should be considered the type rather than the larger more southern plant. That these two American forms are distinct every one must admit after an examination of numerous specimens. The habit, inflorescence and nature of the floral pedicels afford abundant characters for their separation. The *G. Claytoni* of Michaux, although somewhat ambiguous, refers without much doubt to this southern form, as may be inferred from his description, "fascicles of the branches terminal, etc." The writer has therefore adopted this as the oldest name for the species. Does the *G. trifidum* of Linnaeus refer to the slender bog plant with scabrous pedicels? This can be at once decided in the affirmative by a careful analysis of his description; "stem procumbent, peduncles often in threes, very slender, as long as the leaves, one-flowered, flower 3-parted." Willdenow says "habitat in Dania, Canada, Kalm," which makes it all the more probable that this was Linnaeus' plant, since Kalm collected only in the North. It also shows that even Willdenow considered the slender American form identical with the European. This is without doubt correct. After studying several specimens from Germany and Lapland, and inspecting OEder's plate in the Flora Danica no other conclusion can be entertained; they are identical in every essential feature. Very good descriptions are given by Wahlenburg, Roemer and Schultes and Ledebour.

Two varieties of *G. trifidum* are here described as new. Var. *Pacificum*, the more distinct, at first sight seems quite different from our eastern plant. Close examination, however, shows that the essential characters of the two are the same. Both have the diffuse habit, scabrous stems, trifid corolla and slender scabrous pedicels which in this variety are almost always axillary and lateral. The difference is mostly in the leaf. Var. *Pacificum* is the extreme of the *trifidum* series. While the type has but few lateral pedicels, this variety has those only. Somewhat intermediate between these two forms, and having a wider range than the last variety, is the var. *subbiflorum*, including western forms with narrower leaves and stouter more often glabrous pedicels than var. *Pacificum*. These pedicels often show a tendency to become 2- or 3-flowered. It has affinities on the one hand with *G. Claytoni*, and on the other in its smaller forms with *G. Brandegeei*.

G. Brandegeei was described by Dr. Gray from material collected by T. S. Brandegee in northern New Mexico. The essential features separating it from *G. trifidum* were supposed to be its peculiar matted cespitose habit, short stems, small fleshy leaves, and short mostly axillary pedicels. An examination of the type shows that many other Rocky Mountain and Pacific Coast specimens must on this basis be included in this species. Specimens from California, Wyoming, Colorado, Nevada and the Saskatchewan are practically identical with the Brandegee type. *G. Brandegeei* seems to be a good species, although rather closely related to *G. trifidum.* Its essential features are as stated above, the cespitose habit, generally smooth stem, broad and slightly fleshy leaves, and short glabrous one-flowered lateral pedicels.

G. arcuatum is here described as new. It includes a peculiar group of plants somewhat related to *G. bifolium* Wats., as well as to *G. trifidum*, but it is quite distinct from any described species. The distinguishing features are the long rather obtusely angled stem, acute leaves, and short stout recurved lateral pedicels. Specimens were distributed by Mr. Howell named *G. trifidum* var. *cuspidulatum* Gray; otherwise this species has never received a name.

G. tinctorium L. has long been an ambiguous species. Many botanists have attempted to separate it, but so far with very little success. From the description given by Linnaeus one can scarcely tell which plant is meant, but relying upon Willdenow, it is evident that this name must be applied to our large-leaved smooth eastern form with four-cleft corolla. *G. tinctorium* is perhaps the most variable of any species of this group. A careful comparison of a great many specimens, however, enables us to separate it into four well-marked and fairly distinct series, but which are too closely related to allow of specific distinction. The type is here taken to be the ordinary form of the Eastern States, with large leaves varying from linear to lance-ovate. Descriptions given by the early authors fit this better than any other, and besides it is the one most likely to be met with by the early travelers. This type includes the *G. trifidum latifolium* of Torrey and later authors. Specimens intermediate between the broad-leaved form and the narrower are more numerous than either extreme. A very distinct variety, and one that may in the future allow of specific rank, is the var. *Labradoricum*, which toward its southern limit at least inhabits only sphagnous bogs. It was first thought to be a seedling plant of the ordinary form, but material examined from many localities shows it to be quite constant and distinct. The var. *filifolium* includes a well-defined series of Atlantic coast specimens, distinguished by their diffuse habit, naked inflorescence, large flowers, and exceedingly narrow, papillose leaves. Florida specimens of *G. tinctorium* differ from the type in being slender and weak, with spatulate leaves, and a few prickles upon the stem. They are very close to *G. Claytoni*, and have been separated as var. *Floridanum*.

A certain number of American species are distinguished from those discussed above by the lunate cross-section of the seed. The most interesting of all of these is *G. palustre* L. Apparently very few botanists have suspected that this occurs in America, and yet specimens are at hand from all parts of the eastern States. In most herbaria it is labelled *G. trifidum latifolium* Torr. It grows abundantly in the marshes about Cayuga Lake, New York, where the writer has had an opportunity to watch it for several years, thinking it a new species. It was only recently that it occurred to him to compare it with the *G. palustre* of Europe, and the surprise was great indeed when it was found that the two correspond exactly. Material from all parts of the range given below has been compared with specimens from various parts of Europe, and there is now no further doubt but that they are identical. Just as there are few flowered and densely flowered specimens from America, so also specimens are found in Europe with closely cymose infloresence and others bearing only a few flowers.

The question as to whether *G. palustre* is indigenous in America or not is indeed perplexing. Specimens collected at Ithaca have always been in open places near lines of traffic, commonly along roadsides or on the shores of Cayuga Lake. The limited distribution would also suggest its being introduced. On the other hand, the earliest specimen observed was collected by Macrae at Montreal in 1842, and probably the plant referred to by Hooker as *G. tinctorium* was also this species. The question can scarcely be settled at present.

Several specimens from the northwest coast have at the same time a 3-parted corolla, cymose flowers and annular seeds. In habit they suggest *G. asprellum*, but are really quite distinct from any described species. They are here named *G. cymosum.*

There is little to be said about the other species treated in this paper, viz., *G. concinnum*, *asprellum*, *asperrimum* and *triflorum.* They are as a whole quite constant in their characters, and have already been well treated by Dr. Gray in the Synoptical Flora.

A few words might be said about the relation of these species to each other. *G. palustre*, both on account of its fruit and its inflorescence and method of branching, shows an affinity with *G. asprellum*, while the leaves are exactly like those of *G. Claytoni.* It is therefore a transition, as it were, from *G. trifidum* and *G. Claytoni* to *G. asprellum* and its closer relatives. *G. concinnum* stands somewhat alone, its affinity being with *G. asprellum.* The series then progresses through *G. asperrimum*, with slightly hispid fruits to *G. triflorum* with its large broad leaves and long-hirsute carpels, and on to *G. aparine* and its allies.

Below are given the synonomy, description and range of each species and variety discussed in this paper, together with a list of the more important specimens studied taken by States. For convenience, a synopsis of the species is also given.

The writer wishes to express his sincere thanks to Dr. Robinson and Dr. Small, who have kindly loaned him the important collections of *Galium* in their charge for use in the preparation of this paper.

Synopsis of the Species discussed.

A. ENDOSPERM ANNULAR IN CROSS-SECTION; FRUIT GLABROUS.

a. *Flowers in terminal clusters of three, or axillary and solitary.*

* Corolla 4-parted, lobes acute; stem smooth or nearly so.

Leaves linear, acute, mostly in 4's; plant large, stem long and weak; branches 2 or 3 at each node; flowers axillary and solitary on short recurved pedicels; corolla lobes acuminate. Western species. *G. arcuatum.*

Leaves lance-linear, obtuse, mostly in 4's, scabrous on the margin and midrib; plant smaller, stem more strict and (except in one variety) mostly erect; branches commonly solitary; flowers on slender straight pedicels in terminal clusters of three; corolla lobes acute. Species of the Great Plains and eastward. *G. tinctorium.*

* * Corolla 3-parted, small (1½ mm. or less in diam.), lobes obtuse; stem retrorse-hispid, or in *G. Brandegeei* smooth; branches of the plant commonly in 2's or 3's.

Pedicels stout, glabrous; flowers lateral, solitary; plants low and cespitose, stem 4–10 cm. high, mostly glabrous; leaves small, in 4's, broadly spatulate, slightly fleshy, glabrous, veins indistinct; flowers of medium size. Western species. *G. Brandegeei.*

Pedicels slender, scabrous, often almost capillary, solitary and lateral or in terminal clusters of three; stems slender, diffuse, weak and reclining, retrorse hispid; leaves narrowly linear or larger and broadly spatulate, commonly in 4's, scabrous on the margin and midrib; flowers minute. Northern and western species. *G. trifidum.*

Pedicels stout, glabrous, in terminal clusters of three; plants diffusely branched, stem mostly erect, retrorse-hispid; leaves linear, obtuse, scabrous on the margin and midrib, mostly in 5's and 6's, flowers small. Species of the Great Plains and eastward. *G. Claytoni.*

b. *Flowers cymose (pedicels irregularly branching); corolla large, 2 mm. in diam., lobes ovate-triangular, obtuse; leaves commonly in 5's or 6's, obtuse; branches spreading; stem slightly roughened. Western species.* *G. cymosum.*

B. ENDOSPERM LUNATE IN CROSS-SECTION; FLOWERS WHITE, PURPLISH OR GREENISH, NUMEROUS IN TERMINAL AND LATERAL CYMOSE CLUSTERS; COROLLA 4-PARTED; BRANCHES OF THE PLANT IN TWOS OR THREES.

a. *Leaves obtuse, mostly thin and dull, in 2's to 6's; flowers numerous on slender pedicels; corolla white, lobes acute; fruit glabrous. Northeastern species.* *G. palustre.*

b. *Leaves acute or cuspidate.*

Fruit glabrous, pedicels capillary; corolla white, lobes acute or acuminate; leaves linear, slightly mucronate, mostly in 6's; stem low and nearly smooth. Eastern species. *G. concinnum.*

Fruit glabrous on slender pedicels in a very large compound cyme; corolla white, lobes acuminate; leaves short, elliptic-linear, strongly cuspidate, mostly in 6's; stem long and ascending, very retrorse-hispid. Northeastern species. *G. asprellum.*

Fruit minutely uncinate-hispid, pedicels long and capillary; corolla whitish or purplish, lobes acuminate; leaves mostly in 6's, large, linear to broadly elliptic-linear, acute at each end, strongly cuspidate; stem long and weak, very rough. Pacific Coast species. *G. asperrimum.*

Fruit strongly uncinate-hispid; inflorescence few-flowered, pedicels stout, mostly in threes; corolla purplish or greenish, lobes acuminate; leaves mostly in 6's, large, broadly elliptic-linear, cuspidate, more flaccid than in the other species of this section; stems prostrate or rarely ascending, glabrous or hirsute. Distribution general. *G. triflorum.*

1. GALIUM ARCUATUM n. sp.

G. trifidum cuspidulatum Gray, ined.

Perennial, very large; stems ascending or reclining, 3–12 dm. high, glabrous, rather obtusely angled, diffusely branched, branches two or three at each node; leaves elliptic-linear, acute at each end (7–22 mm. by 1–4 mm.), 1-nerved, thin, commonly in 4's, unequal, scabrous on the margin and midrib; flowers axillary (rarely terminal), solitary at each node, on mostly stout glabrous recurved pedicels which are much shorter than the leaves (2–7 mm. long); corolla white, rather large (3 mm. diam.), 4-parted, lobes acuminate; fruit glabrous, mature fruit not seen.

A well-defined form quite distinct from other western species. Specimens distributed by Mr. Howell were named *G. trifidum cuspidulatum* Gray. This species varies considerably in size, some plants being much more slender than the type.

Northern California.

California, Holder, no. 2580 (1863); Rattan, no. 544b (1866); Trinity Co., Rattan (1883); Siskyou Co., Howell, no. 137 (1886).

2. GALIUM TINCTORIUM L. Sp. Pl. 106. 1753.

DC. Prod. 4: 597. 1830. Torr. Fl. N. & Mid. States, 78. 1826. Pursh, Fl. Am. Sept. 102. 1814.

G. trifidum (in part) of American authors.

G. trifidum latifolium Torr. Fl. N. & Mid. States, 78. 1826.

G. obtusum Bigelow, Fl. Bost. ed. 2, 55. 1824.

Perennial, erect, 15–25 cm. high, usually rather stiff, much branched almost to the base, branches commonly solitary, strict (not irregularly diffuse), several times forked; stem 4-angled, glabrous or very nearly so; leaves commonly in 4's, linear to lanceolate (15–25 mm. long) broadest below the middle, obtuse, cuneate at the base, 1-nerved, margin and midrib slightly scabrous, dark-green and dull, not papillose; flowers terminal in clusters of 2–3, pedicels slender, not conspicuously divaricate even in fruit; corolla white, large (2–3½ mm. diam.), 4-parted, lobes oblong, acute; fruit smooth; endosperm spherical, hollow, annular in cross-section.

A form occurs along the coast and in Oswego, Co., N. Y., differing from the type in being more slender and weaker, leaves linear, inflorescence naked and larger flowered; perhaps distinct.

An examination of fresh material obtained at Ithaca, N. Y., shows that *G. tinctorium* differs also from all other species here treated except *G. asprellum* (*G. arcuatum*, *Brandegei*, *cymosum* and *asperrimum* not examined) in having a much larger disc at the base of the corolla.

Damp shady places and swamps: Canada to North Carolina and Tennessee, westward to Michigan, Nebraska, Indian Territory and Arizona.

Canada: Macoun, no. 77 (1877); Scott (1890); Holmes.

Massachusetts: Oakes.

New York: Petit; Sartwell; Torrey; Ouray (1834); Dudley.

New Jersey: Leggett (1868); Torrey.

North Carolina: Torr. Herb.

Tennessee: Bain, no. 294 (1893).

Kentucky: Short (1831); Peter (1893).

Illinois: Patterson.

Ohio: Kofoid (1891).

Michigan:

Minnesota: Ballard (1891).

Nebraska: Clements, no. 2554 (1895). In part.

Kansas: Norton, no. 204 (1895).

Arkansas: Harvey, no. 88.

Indian Territory: Bush, no. 1134 (1895).

Arizona: Palmer, no. 514 (1890).

Galium tinctorium filifolium n. var.

More slender than the type and often more diffuse; leaves almost filiform (2 mm. or less broad), not broader below the middle, strongly cellular papillose; inflorescence more open, pedicels slender, bracts minute; flowers in twos or threes, corolla larger.

Sandy places in swamps; Virginia to Florida along the coast.

Type in Herb. Cornell Univ; Bladen Co., N. C., Beadle no. 479 (1896).

Virginia: Curtiss (1855).

North Carolina: Schweinitz.

South Carolina: Hexamer and Maier (1855).

Georgia: no collector.

Florida: Rugel (1843).

Galium tinctorium Floridanum n. var.

A weak slender form decumbent at the base; leaves spatulate-linear, of medium size, flaccid; stem slightly hispid; flowers 4-parted (rarely in a few flowers 3-parted), on slender pedicels, occasionally axillary and solitary.

Florida.

Type in Herb. Cornell Univ.; Florida, Nash, no. 152 (1894); Pierce (1887); Curtiss, no. 4711 (1894); Straub, no. 104 (1895).

GALIUM TINCTORIUM LABRADORICUM n. var.

Low and strictly erect, 5–25 cm. high; branches few, ascending, mostly from the upper nodes; stem as in the type; leaves small (7–8 mm. long), linear, reflexed; flowers large.

In sphagnous bogs; Connecticut, New York and Wisconsin, northward to Labrador.

Type in Herb. Cornell Univ.; Oswego Co., N. Y., Rowlee and Wiegand (1895).

Connecticut: Torr. Herb.

New York: Torr. Herb.

Wisconsin: Lapham.

Lake Superior: Lorings.

Newfoundland: Waghorne (1893).

Labrador: Storer.

3. GALIUM BRANDEGEEI Gray, Proc. Amer. Acad. **12**: 58. 1877.

Perennial and cespitose forming dense mats; stems low and prostate or ascending (5–12 cm. long), slender and rather densely leafy, smooth or nearly so; branches when present solitary; leaves in fours, unequal, obovate-spatulate, small (10 mm. or less), rounded at the apex, cuneate at the base, somewhat fleshy, dull on both surfaces, veins indistinct, margins and midrib glabrous; flowers lateral, commonly gemmate, on glabrous arcuate pedicels which are as long or longer than the leaves; corolla of medium size, white 3-parted, lobes broadly oval, obtuse; fruit glabrous, endosperm spherical, hollow, annular in cross-section.

This species is closely related to *G. trifidum subbiflorum*, but is distinguished by its peculiar matted habit, commonly glabrous stem, thicker leaves and stouter glabrous pedicels. In one of the Colorado plants the corolla shows a tendency to become 4-parted. Some California specimens have rough stems.

Northern New Mexico and Arizona to California and the Saskatchewan.

New Mexico: Brandegee (1875) type.

Arizona:

California: Lemmon, no. 1217 (1875); Bolander, no. 5025 (1866); Parish, no. 3320 (1894).

Colorado: Crandall, no. 281 (1894).

Wyoming: Nelson, no. 1763 (1895).

Saskatchewan: Macoun (1885).

4. GALIUM TRIFIDUM L. Sp. Pl. 105. 1753.

Fl. Dan. *pl. 48*. Wahl. Fl. Lap. 47. 1812. Roem. & Schul. Syst. Ledeb. Fl. Ross. Big. Fl. Bost. ed. 2, 56. 1824. DC. Prod. 4: 597. 1830.

G. trifidum pusillum Gray, Man. ed. 5, 209. 1867.

Perennial from slender rootstocks, very slender and weak, ascending, 40 cm. or less long, much branched and intertangled; stem sharply 4-angled, rough; branches commonly in twos; leaves in fours, linear-spatulate, 5–13 mm. long, obtuse, cuneate at the base, 1-nerved, dark-green and dull on both surfaces, scarcely papillose, margins and midrib retrorse-scabrous; flowers solitary on lateral or terminal pedicels which are capillary, scabrous and arcuate at the apex, much longer than the leaves, commonly two at each node or three terminal; corolla very small, white, ½ mm. long, trifid, lobes broadly oval, very obtuse; fruit glabrous; endosperm spherical and hollow, annular in cross-section.

Sphagnous bogs and cold swamps. Maine to southern New York, Ohio, Nebraska, Colorado and northward.

Maine: Fernald, no. 412 (1895); Parlin (1885).

Vermont: Grout and Eggleston (1894).

Central New York: Dudley and others; Britton (1886).

Ohio: Werner (1891).

Nebraska: Rydberg, no. 1418 (1893).

Michigan: Britton (1886).

Colorado: Wolf, no. 16–17 (1873).

GALIUM TRIFIDUM SUBBIFLORUM n. var.

Stems less scabrous than in the type, somewhat stouter; leaves larger, very unequal (8–10 mm. by 2 mm.), flaccid and nearly smooth; pedicels capillary and as long as the leaves, or sometimes rather stout; rarely two or even three-flowered, nearly glabrous.

This variety approaches *G. Claytoni* and *G. Brandeegei.* The specimens examined are nearly all much discolored as if the leaves might be slightly fleshy.

Arizona and California to Oregon and the Saskatchewan.

Type in Herb Cornell Univ. Colorado, Hall and Harbour, no. 230 (1862).

Arizona: Palmer.

Utah: Watson, no. 485 (1869).

California: Kellogg (1866); Bolander, no. 5348 (1866); Parish. no. 1505 (1882); Eastwood (1894).

Oregon: Lyall (1858); Cronkhite (1864); Cusick no. 1397 (1886).

Colorado: Patterson (1892).

Wyoming: Nelson, no. 1115 (1894).

Saskatchewan: Bourgeau (1858).

GALIUM TRIFIDUM PACIFICUM n. var.

Larger and stouter than the type; leaves unequal, mostly in 4's, large and broadly oblong-spatulate, obtuse, cuneate at the base (15–23 mm. by 3–5 mm.), thin and flaccid; pedicels lateral, capillary, scabrous and arcuate as in the type, 1-flowered, equalling the leaves or shorter; corolla minute, 3-parted.

Some Washington specimens have nearly glabrous pedicels.

California to Washington.

Type in Herb. Cornell Univ.; Placer Co., Cal., Carpenter (1892), Bottom lands of the Columbia River, Suksdorf, no. 1661 (1893).

5. GALIUM CLAYTONI Michx. Fl. Bor. Am. 1: 78. 1803.

Roem. & Schul. Syst. Hooker, Fl. Bor. Am.

G. trifidum Pursh, Fl. Am. Sept. 103. 1814. Torr. Fl. N. & M. States, 78. 1826. Darl. Fl. Cest.

G. trifidum (in part) T. & G. Fl. N. A. 2: 22. 1841. DC. Prodr. 4: 597. 1830.

G. tinctorium Bigelow, Fl. Bost. ed. 2, 54. 1824.

Perennial; erect or ascending, becoming more diffuse when old, 15–60 cm. high; stem slender, or in some specimens quite stout, sharply 4-angled, more or less rough, the diffuse branches in 2's; leaves of medium size (8–15 mm. long), commonly in 5's or 6's, linear-spatulate or spatulate-oblong, obtuse, cuneately narrowed into a short petiole, rather firm in texture, scabrous on the margin and midrib, dark-green and dull above, not papillose, discolored in drying; flowers in clusters of 2's or 3's, terminal, provided with 1 or 2 minute bracts; pedicels straight, in fruit strongly divaricate, glabrous and rather stout; corolla minute, white, 3-parted, lobes broadly oval, obtuse; fruit glabrous; endosperm spherical and hollow, annular in cross-section.

This species, heretofore confounded with *G. trifidum*, embraces all the eastern forms with trifid corolla and scabrous stems not included under *G. trifidum*. Although somewhat variable, no varieties can be distinguished. It forms, however, a fairly well defined species. Its closest relative is *G. trifidum*, from which it differs in its more robust habit, clustered terminal flowers and stouter glabrous pedicels. The southern Atlantic specimens have broader leaves and more slender pedicels than the type.

Swamps, Massachusetts and New York to North Carolina, Texas, Michigan and Nebraska.

Massachusetts: Boott (1853).

New York: Dudley and others.

Virginia: Small (1892); Heller (1893); Britton (1892).

North Carolina: Beardslee and Kofoid (1891); Torr. Herb.

Ohio: Sullivant.

Michigan: Farwell, no. 758 (1890).

Illinois: Eggert (1891).

Nebraska: Rydberg, no. 1840; Clements no. 2554 (1893). In part.

Texas: Reverchon (1876).

New Mexico: Wright, no. 1115 (1851).

6. GALIUM CYMOSUM n. sp.

Perennial; erect or ascending, 3–8 dm. high; stem 4-angled, more or less roughened, internodes long (4–6 cm.), diffusely branched, branches in 2's or 3's; leaves in 5's or 6's, linear, 10–17 mm. long, obtuse, thin, scabrous on the margin and midrib, scarcely papillose; flowers numerous, in terminal and lateral cymes; bracts foliaceous, small; pedicels short and slender, in flower mostly divaricate, in fruit strongly so; corolla white, large (2 mm. diam.), 3-parted, lobes triangular-ovate, obtuse; fruit glabrous; endosperm spherical and hollow, in cross-section annular.

Plant with an aspect intermediate between *G. Claytoni* and *G. asprellum.*

Oregon to British Columbia.

Type in Herb. Cornell Univ. Tacoma, Washington, J. B. Fleet (1896).

Oregon: Hall, no. 232 (1871).

British Columbia: Scouler.

7. GALIUM PALUSTRE L. Sp. Pl. 105. 1753.

Fl. Dan. *pl. 423. G. trifidum* (in part) and *G. tinctorium* (in part) of American authors.

? G. trifidum bifolium Macoun, Cat. Can. Plants, 202. 1884.

Perennial, erect and rather slender, about 40 cm. high; internodes very long (middle 6–7 cm. long), short branches mostly in

2's, stem sharply 4-angled, glabrous or slightly scabrous; leaves in typical specimens rather small, in 2's to 6's, linear-elliptic or spatulate, cuneate at the base, obtuse (7–10 mm. by 2–3 mm.), rather firm, margins and midrib slightly scabrous, not papillose, reduced to two at the upper nodes; flowers numerous in terminal and lateral cymes; bracteoles in the inflorescence minute; pedicels in flower ascending, 3–5 mm. long, in fruit strongly divaricate; corolla large, white (2½–3¼ mm. diam.), 4-parted, lobes oblong, acute; disk at the base almost obsolete; fruit glabrous; endosperm grooved on the inner face, in cross-section lunate.

Typically with small leaves and densely cymose inflorescence, but varying into large-leaved forms with few flowers, seemingly dependent upon the habitat. Many of these latter have most of the upper leaves in 2's, and although Prof. Macoun's type has not been seen, it seems probable that his var. *bifolium* is to be referred here. *G. palustre* grows mostly in patches, and late in the season creeping branches are sent out, forming dense green mats which remain green until covered by the snow. When in flower it is quite showy, the pure white patches being very conspicuous.

In damp shady or open places along roadsides and ditches, or in the margins of swamps. Newfoundland, Prince Edward's Island, and Canada to Massachusetts and New York.

Newfoundland: Robinson & Schrenk, no. 214 (1894).
Prince Edward's Island: Macoun (1888).
Canada, at Montreal, Macrae (1842).
Maine: Fernald (1891).
Massachusetts: Sears (1887).
Central New York: Dudley and others.

8. GALIUM CONCINNUM T. & G. Fl. N. A. 2: 23. 1841.

Endosperm deeply grooved.

Dry hillsides; Pennsylvania to Virginia, and westward to Minnesota, Iowa and Arkansas.

9. GALIUM ASPRELLUM Michx. Fl. Bor. Am. 1: 78. 1803.

DC. Prod. 4: 598. 1830. T. & G. Fl. N. A. 2: 23. 1841.
G. Pennsylvanicum Muhl. Cat.
G. spinulosum Raf. Prec. Decouv. 40. 1814.
G. micranthum Pursh, Fl. Am. Sept. 103. 1814. Except fruit.

Endosperm with a shallow groove.

Alluvial river banks and swamps; Newfoundland and Ontario to Pennsylvania and west to Wisconsin.

10. GALIUM ASPERRIMUM Gray, Mem. Amer. Acad. 4: 60. 1849. Bot. Calif. 1: 284. 1880.

G. asperrimum asperulum Gray, Bot. Calif. 1: 284. 1880.

Endosperm with a shallow groove. A variable species. The type and also other specimens from New Mexico and Arizona have small very scabrous leaves and a very large diffuse panicle. The type of variety *asperulum* Gr. (Watson, Nevada) is nearly glabrous with thinner leaves and few flowered inflorescence; other specimens from Washington, Oregon, California and Arizona have large and broad rather firm leaves. No distinct variety can be separated.

Washington to California, Utah, Arizona and New Mexico.

11. GALIUM TRIFLORUM Michx., Fl. Bor. Am. 1: 80. 1803.

Pursh, Fl. Am. Sept. 104. 1814. DC. Prod. 4: 601. 1830. Hooker, Fl. Bor. Am. T. & G. Fl. N. A. 2: 23. 1841.

G. cuspidatum Muhl. Cat.

G. brachiatum Pursh, Fl. Am. Sept. 103. 1814.

G. Pennsylvanicum Bart, Comp. Fl. Philad. 83.

Endosperm almost spherical, groove nearly obsolete. Specimens from Nebraska, New York, Connecticut and Massachusetts are more or less hirsute. The southern plants are somewhat smaller leaved, while some of the Pacific coast specimens have long slender pedicels (1½–4 cm.); others from Oregon and British Columbia have narrower leaves than the type.

Damp shady places; Labrador and Northern Canada to Florida and Louisiana, across the continent, south to northern California and Colorado.

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